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Test 1037: Case 970 Power Shift Diesel

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 1037—CASE 970 POWER SHIFT DIESEL

POWER TAKE-OFF PERFORMANCE

Hp	Crank- shaft speed rpm	Fuel Consumption Gal per hr	Lb per hp-hr	Hp-hr per gal	Temperature Degrees F Cooling medium	Air wet bulb	Air dry bulb	Barometer inches of Mercury
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MAXIMUM POWER AND FUEL CONSUMPTION

Rated Engine Speed—PTO Speed 538 RPM—Two Hours

85.3½	1900	5.432	0.441	15.71	183	56	75	29.150
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VARYING POWER AND FUEL CONSUMPTION—TWO HOURS

75.13	1969	4.879	0.450	15.40	178	56	76
0.00	2080	1.707	.....	.....	150	56	76	.....
38.67	2033	3.237	0.580	11.95	173	56	75	.....
84.41	1900	5.395	0.442	15.65	177	56	76	.....
19.54	2055	2.405	0.852	8.12	163	55	75	.....
57.29	2004	4.017	0.485	14.26	176	56	77	.....
Av 45.84	2007	3.607	0.545	12.71	169	56	76	29.108

DRAWBAR PERFORMANCE

Hp	Draw- bar pull lbs	Speed miles per hr	Crank- shaft speed rpm	Slip of drivers %	Fuel Consumption Gal per hr	Lb per hp-hr	Hp-hr per gal	Temp Cool- ing med	Degrees F Air wet bulb	Air dry bulb	Barometer inches of Mercury
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VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST

Maximum Available Power—Two Hours 7th Gear (2nd High)

71.56	5585	4.80	1904	5.43	5.295	0.512	13.51	180	52	65	28.765
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75% of Pull at Maximum Power—Ten Hours 7th Gear (2nd High)

59.65	4394	5.09	1981	3.76	4.642	0.539	12.85	179	53	64	28.419
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50% of Pull at Maximum Power—Two Hours 7th Gear (2nd High)

41.26	2942	5.26	2014	2.08	3.591	0.603	11.49	180	66	74	28.415
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MAXIMUM POWER WITH BALLAST

61.79	10671	2.17	1969	14.93	2nd Gear (1st Inter.)	186	50	64	28.820
70.38	9698	2.72	1898	11.68	4th Gear (1st High)	194	52	68	28.820
73.91	7382	3.75	1902	7.75	5th Gear (2nd Inter.)	195	52	68	28.810
74.53	6534	4.28	1903	6.60	6th Gear (3rd Low)	195	53	68	28.810
74.48	5837	4.79	1901	5.80	7th Gear (2nd High)	195	52	66	28.800
73.25	4711	5.83	1904	4.60	8th Gear (3rd Inter.)	195	52	68	28.790
72.36	3694	7.35	1899	3.53	9th Gear (3rd High)	190	52	67	28.790
71.45	2714	9.87	1903	2.44	10th Gear (4th Lo)	188	52	67	28.790

MAXIMUM PULL WITHOUT BALLAST

58.14	7964	2.74	1963	14.91	4th Gear (1st High)	183	61	85	28.390
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VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—7th Gear (2nd High)

Pounds Pull	5837	6415	6748	6688	6849	6611
Horsepower	74.48	72.86	68.52	59.16	52.09	41.71
Crankshaft Speed rpm	1901	1704	1532	1331	1148	950
Miles Per Hour	4.79	4.26	3.81	3.32	2.85	2.37
Slip of Drivers %	5.80	6.31	6.60	6.60	6.89	6.75

TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 18.4-38; 8; 18	Two 18.4-38; 8; 16
Ballast	—Liquid	1178 lb each	None
	Cast iron	580 lb each	None
Front tires	—No, size, ply & psi	Two 10.00-16; 8; 40	Two 10.00-16; 8; 40
Ballast	—Liquid	None	None
	Cast iron	10 lb each	None
Height of drawbar		18½ inches	19½ inches
Static weight with operator—Rear		10710 lb	7195 lb
	Front	3160 lb	3140 lb
	Total	13870 lb	10335 lb

Department of Agricultural Engineering

Dates of Test: April 15, 1970 to April 28, 1970

Manufacturer: J. I. CASE COMPANY, RACINE, WISCONSIN

FUEL, OIL and TIME Fuel No 2 Diesel Cetane 50.8 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8319 Weight per gallon 6.926 lb Oil SAE 30 API service classification MS-DS To motor 2.880 gal Drained from motor 2.760 gal Transmission and final-drive lubricant Case TCH oil Total time engine was operated 54½ hours.

ENGINE Make Case Diesel Type 6 cylinder vertical Serial No 2312277 Crankshaft mounted lengthwise Rated rpm 1900 Bore and stroke 4¼" x 5" Compression ratio 16.5 to 1 Displacement 401 cu in Cranking system 12 volt electric (2 12-volt batteries) Lubrication pressure Air cleaner dry type with replaceable pleated paper element Oil filter full flow replaceable cartridge Oil cooler radiator for transmission and hydraulic oil Fuel filter replaceable primary and secondary filter cartridges Muffler was used Cooling medium temperature control thermostat.

CHASSIS Type Standard Serial No 8659063 Tread width rear 62" to 88" front 62" to 90" Wheel base 108" Center of gravity (without operator or ballast, with minimum tread, with fuel tank filled and tractor serviced for operation) Horizontal distance forward from center-line of rear wheels 33.2" Vertical distance above roadway 39.2" Horizontal distance from center of rear wheel tread 0" to the right/left Hydraulic control system direct engine drive Transmission selective gear fixed ratio with partial range operator controlled power shifting Advertised speeds mph first 1.8 second 2.5 third 3.0 fourth 3.1 fifth 4.0 sixth 4.6 seventh 5.0 eighth 6.2 ninth 7.7 tenth 10.2 eleventh 13.7 twelfth 17.0 reverse 3.1, 5.0, 7.7, 17.0 Clutch multiple disc wet clutches within transmission hydraulically actuated Brakes dry double disc hydraulically power actuated with two foot pedals which can be locked together Steering hydrostatic Turning radius (on concrete surface with brake applied) right 163" left 163" (on concrete surface without brake) right 182" left 182" Turning space diameter (on concrete surface with brake applied) right 338" left 338" (on concrete surface without brake) right 378" left 378" Belt pulley 1108 rpm at 1900 engine rpm diam 10.5" face 7.25" Belt Speed 3045 fpm Power take-off 538 rpm at 1900 engine rpm.

REPAIRS and ADJUSTMENTS: No repairs or adjustments.

REMARKS: All test results were determined from observed data obtained in accordance with the SAE and ASAE test code. First gear was not run as it was necessary to limit the pull in second gear because of excessive slippage. Third, eleventh, and twelfth gears were not run as test procedure requires only eight runs.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 1037.

L. F. LARSEN

Engineer-In-Charge

G. W. STEINBRUEGGE, Chairman

W. E. SPLINTER

D. E. LANE

Board of Tractor Test Engineers

The University of Nebraska Agricultural Experiment Station
E. F. Frolik, Dean; H. W. Ottoson, Director; Lincoln, Nebraska

EXPLANATION OF TEST REPORT

GENERAL CONDITIONS

Each tractor is a production model equipped for common usage. Power consuming accessories can be disconnected only when it is convenient for the operator to do so in practice. Additional weight can be added as ballast if the manufacturer regularly supplies it for sale. The static tire loads and the inflation pressures must conform to recommendations in the Tire Standards published by the Society of Automotive Engineers.

PREPARATION FOR PERFORMANCE RUNS

The engine crankcase is drained and refilled with a measured amount of new oil conforming to specifications in the operators manual. The fuel used and the maintenance operations must also conform to the published information delivered with the tractor. The tractor is then limbered-up for 12 hours on drawbar work in accordance with the manufacturer's published recommendations. The manufacturer's representative is present to make appropriate decisions regarding mechanical adjustments.

The tractor is equipped with approximately the amount of added ballast that is used during maximum drawbar tests. Prior to the maximum power run the tire tread-bar height must be at least 65% of new tread height.

BELT OR POWER TAKE-OFF PERFORMANCE

Maximum Power and Fuel Consumption. The manufacturer's representative makes carburetor, fuel pump, ignition and governor control settings which remain unchanged throughout all subsequent runs. The governor and the manually operated governor control lever is set to provide the high-idle speed specified by the manufacturer for maximum power. Maximum power is measured by connecting the belt pulley or the power take-off to a dynamometer. The dynamometer load is then gradually increased until the engine is operating at the rated speed specified by the manufacturer for maximum power. The corresponding fuel consumption is measured.

Varying Power and Fuel Consumption. Six different horsepower levels are used to show corresponding fuel consumption rates and how the governor causes the engine to react to the following changes in dynamometer load: 85% of the dynamometer torque at maximum power; minimum dynamometer torque, $\frac{1}{2}$ of the 85% torque; maximum power, $\frac{1}{4}$ and $\frac{3}{4}$ of the 85% torque. Since a tractor is generally subjected to varying loads the average of the results in this test serve well for predicting the fuel consumption of a tractor in general usage.

DRAWBAR PERFORMANCE

All engine adjustments are the same as those used in the belt or power take-off tests.

Varying Power and Fuel Consumption With Ballast. The varying power runs are made to show the effect of speed-control devices (engine, governor, automatic trans-

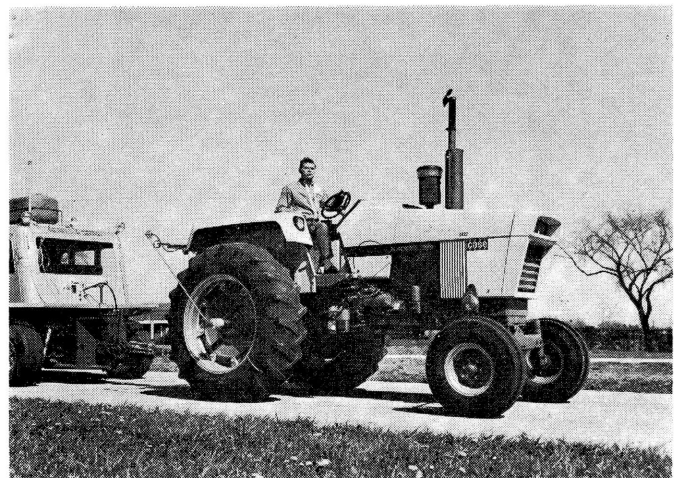
mission, etc.) on horsepower, speed and fuel consumption. These runs are made around the entire test course which has two 180 degree turns with a minimum radius of 50 feet. The drawbar pull is set at 3 different levels as follows: (1) as near to the pull at maximum power as possible and still have the tractor maintain the travel speed at maximum horsepower on the straight sections of the test course; (2) 75% of the pull at maximum power; and (3) 50% of the pull at maximum power.

Maximum Power with Ballast. Maximum power is measured on straight level sections of the test course. Data are shown for not more than 8 different gears or travel speeds. Some gears or travel speeds may be omitted because of high slippage of the traction members or because the travel speed may exceed the safe-limit for the test course. The manufacturer's representative has the option of selecting one gear or speed over eight miles per hour. The maximum safe speed for the Nebraska Test Course has been set at 15 miles per hour. The slippage limits have been set at 15% and 7% for pneumatic tires and steel tracks or lugs, respectively. Higher slippage gives widely varying results.

Maximum Pull without Ballast. All added ballast is removed from the tractor. The drawbar pull is determined at slip limits of 15% for pneumatic tires or 7% for steel tracks or lugs. The tractor is operated at the fastest possible travel speed.

Varying Drawbar Pull and Travel Speed with Ballast. Travel speeds corresponding to drawbar pulls beyond the maximum power range are obtained to show the "lugging ability" of the tractor. The run starts with the pull at maximum power; then additional drawbar pull is applied to cause decreasing speeds. The run is ended by one of three conditions: (1) maximum pull is obtained, (2) the maximum slippage limit is reached, or (3) some other operating limit is reached.

For additional information about the Nebraska Tractor Tests write to the Department of Agricultural Engineering, University of Nebraska, Lincoln, Nebraska 68503.



CASE 970 POWER SHIFT DIESEL